The Potential of Biofuels for Africa

Presentation at the IPC workshop, Zambia June 2007

Andrew Makenete
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I. Introduction
   I. What are biofuels
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V. Conclusion
INTRODUCTION: What are Biofuels

Biofuels are fuels made from sugar, starch and oil biomass resources. Biofuels include bioethanol, biodiesel and ethanol gel.

• **Biodiesel feedstocks currently commercialised**
  – Soybean oil
  – Palm oil
  – Rapeseed/canola oil
  – Sunflower oil
  – Cotton seed oil
  – Coconut oil

• **Bioethanol feedstocks currently commercialised**
  – Maize / corn
  – Sugar cane
  – Sugar beet
  – Wheat
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  – Sugar cane
  – Sugar beet
  – Wheat
INTRODUCTION: The Case for Biofuels
INTRODUCTION: The Case for Biofuels
INTRODUCTION: Northern Hemisphere Supply Constraints

EU Biofuel Feedstock Supply and Demand

Bioethanol feedstock

Biodiesel feedstock

Source: Shell Global Biofuels
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POTENTIAL: Southern Africa – Highest Potential

**Africa – The “Green OPEC”**

- **Sub-Saharan Africa – highest potential**
  - Maximum 410 exajoules
  - Abundant land and labour

- **But needs:**
  - Improved agriculture – fertiliser, pesticides
  - Mass irrigation
  - Efficient use of animal feed – feedlotting

- **Important synergies**
  - Poverty alleviation, rural development
  - Energy security – esp in rural areas

- **Pan-African Non-Petroleum Producers Association**
  - Formed in 2006
  - 12 African countries
  - Aim to develop boost African biofuels industry

- **Africa to farm for Asia**
  - John Maudlin – investment guru
  - African farms the best bet for long term investment because land, labour abundant

*BioEnergy Task Group, Copernicus Institute, Uni Utrecht*
POTENTIAL: Southern Africa – Highest Potential

<table>
<thead>
<tr>
<th>International Cooperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Trilateral co-operation:</strong></td>
</tr>
<tr>
<td>– EU <strong>country</strong> – brings financial and technical resources, offtaker</td>
</tr>
<tr>
<td>– <strong>Brazil</strong> – scientific, agronomic and technical expertise</td>
</tr>
<tr>
<td>– <strong>Africa</strong> – biofuel producer</td>
</tr>
</tbody>
</table>

• **Benefit:**
  – EU can use its resources to secure clean energy supplies
  – AND lift marginalised farmers out of poverty

• **EU and Brazil partnerships (2007)**
  – **Italy** – Brazilian oil co (Petrobras), Italian energy co (Eni SpA)
    - Export biofuels to Italy from Mozambique, Angola, DRC
  – **UK and Netherlands**
    - finance African biofuel projects with Brazilian technology

• **MOU: South Africa and Brazil (2006)**
  – Technology and R&D exchange on sugar-to-ethanol production
THE GREEN OPEC – Rainfall Pattern in the SADC Region

Source: FANR
### THE GREEN OPEC – Cropland Potential for Five SADC Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Land (million ha)</th>
<th>Suitable crop land (million ha)</th>
<th>Area under crops today</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRC</td>
<td>227</td>
<td>45</td>
<td>8</td>
</tr>
<tr>
<td>Angola</td>
<td>125</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>Tanzania</td>
<td>88</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Zambia</td>
<td>74</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Mozambique</td>
<td>78</td>
<td>16</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Feasibility Study for SADC Biofuel Production and Use, 2005
THE GREEN OPEC – Ethanol Production Potential

Cassava

Maize

International Institute for Applied Systems Analysis, FAO

“African farms the best bet for international investors with long-term horizons” – John Maudlin
## THE GREEN OPEC – Annual Production of Cassava and Maize in SADC

<table>
<thead>
<tr>
<th></th>
<th>2004 Maize</th>
<th>2004 Cassava</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area 000ha</td>
<td>Tons 000t</td>
</tr>
<tr>
<td>Angola</td>
<td>980</td>
<td>510</td>
</tr>
<tr>
<td>DRC</td>
<td>1 450</td>
<td>1 155</td>
</tr>
<tr>
<td>Moz</td>
<td>1 300</td>
<td>1 248</td>
</tr>
<tr>
<td>Tanz</td>
<td>1 580</td>
<td>2 800</td>
</tr>
<tr>
<td>Zam</td>
<td>750</td>
<td>1 161</td>
</tr>
<tr>
<td>Africa</td>
<td>27 178</td>
<td>43 390</td>
</tr>
<tr>
<td>World</td>
<td>147 022</td>
<td>721 379</td>
</tr>
</tbody>
</table>

Source: Feasibility Study for SADC Biofuel Production and Use, 2005
THE GREEN OPEC – Ethanol Production Potential

Sorghum

Sugar cane

International Institute for Applied Systems Analysis, FAO

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## THE GREEN OPEC – Annual Production of Sorghum and Sugarcane in SADC

<table>
<thead>
<tr>
<th>Country</th>
<th>2004 Sorghum</th>
<th>2004 Sugarcane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area 000ha</td>
<td>Tons 000t</td>
</tr>
<tr>
<td>Angola</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>DRC</td>
<td>85</td>
<td>54</td>
</tr>
<tr>
<td>Moz</td>
<td>515</td>
<td>314</td>
</tr>
<tr>
<td>Tanz</td>
<td>620</td>
<td>650</td>
</tr>
<tr>
<td>Zam</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>Africa</td>
<td>25 012</td>
<td>21 001</td>
</tr>
<tr>
<td>World</td>
<td>43 727</td>
<td>58 884</td>
</tr>
</tbody>
</table>

Source: Feasibility Study for SADC Biofuel Production and Use, 2005
THE GREEN OPEC – Biodiesel Production Potential

“African farms the best bet for international investors with long-term horizons” – John Maudlin

Oil palm

Soya

International Institute for Applied Systems Analysis, FAO
## THE GREEN OPEC – Annual Production of Oil Palm and Soya in SADC

<table>
<thead>
<tr>
<th></th>
<th>2004 Oil Palm</th>
<th>2004 Soya</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area 000ha</td>
<td>Tons 000t</td>
</tr>
<tr>
<td>Angola</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRC</td>
<td>30</td>
<td>14.6</td>
</tr>
<tr>
<td>Moz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanz</td>
<td>5.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Zam</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Africa</td>
<td>1 117</td>
<td>1 054</td>
</tr>
<tr>
<td>World</td>
<td>91 443</td>
<td>204 266</td>
</tr>
</tbody>
</table>

Source: Feasibility Study for SADC Biofuel Production and Use, 2005
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<table>
<thead>
<tr>
<th>South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Fuel demand – highest in SADC</strong></td>
</tr>
<tr>
<td>– 12bn ltrs/year</td>
</tr>
<tr>
<td>– SADC will need 400 x 30 000t plants to meet</td>
</tr>
<tr>
<td>– Dieselification</td>
</tr>
<tr>
<td>• <strong>Feedstock production potential</strong></td>
</tr>
<tr>
<td>– Maize, sugar, canola, soya</td>
</tr>
<tr>
<td>– But limited by climate, land, water</td>
</tr>
<tr>
<td>• <strong>Infrastructure</strong></td>
</tr>
<tr>
<td>– Refineries, pipelines can accept biofuels</td>
</tr>
<tr>
<td>– Booming economy demands fuel</td>
</tr>
<tr>
<td>• <strong>Capacity</strong></td>
</tr>
<tr>
<td>– Research and development – gvt &amp; pvt sector</td>
</tr>
<tr>
<td>– Southern African Biofuel Association</td>
</tr>
<tr>
<td>– Regulatory framework in place</td>
</tr>
<tr>
<td>- Amendments to Petroleum Act  iro licensing, BEE involvement, biofuel introduction</td>
</tr>
<tr>
<td>• <strong>Export potential</strong></td>
</tr>
<tr>
<td>– Ports – Coega, Richards Bay, Durban, Cape Town</td>
</tr>
</tbody>
</table>
Dieselisation of the personal vehicle fleet

From 2005 to 2006
313 million litres 'less' Petrol
‘transferred’ to
303 million litres 'more' Diesel

Source: Sapia
STIMULATING AFRICAN ECONOMIES – South African Logistics Analysis
STIMULATING AFRICAN ECONOMIES – South African Logistics Analysis

Legend
- Ethanol Plant Locations

Off Takers
- Type
  - Feedlots
  - Refinery

Ethanol Transported (MT/an)
- 58589

Roads
- Class
  - National
  - Main and Trunk
  - Secondary

Absa AgriBusiness
STIMULATING AFRICAN ECONOMIES – South African Logistics Analysis
Biodiesel – Powering Nigerian cellphone stations

• **African base stations**
  – Consume 30m litres diesel/year
  – Diesel is often imported
  – Diesel can account for 50% of operating costs
  – Need good roads to transport diesel and secure areas to store the fuel

• **GSM Association partnership with Ericsson and MTN**
  – Pilot use of biodiesel in telecom industry

• **Nigeria**
  – 20m GSM subscribers in 2006 (from 1m in 2000)
  – 70% of population excluded, live in rural areas
  – Only 25% of base stations grid connected
  – 2007 - 3 biodiesel-powered base stations
    - Locally grown soya feedstock
    - 18 000lt diesel/station/year

Source: GSM Association
Tanzania – powering cement kilns with biomass

- **African Rural Energy Enterprise Development**
  - UNEP-funded initiative
  - offers enterprise development services and financing for “clean energy” projects in Africa

- **Tanga Cement Company Limited**
  - Replaced fossil fuels with biomass
  - Company co-ordinates sourcing of biomass wastes as fuel for kilns
  - Displaces 15% of fossil fuels – 6 600t
  - Reduces GHG emissions
  - Rural women earn $60/month collecting charcoal residues for the plant
    - exceeds minimum wage

Source: AReed
<table>
<thead>
<tr>
<th>Ethanol gel – Eliminating a Major Health Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unsafe paraffin stoves</strong></td>
</tr>
<tr>
<td>- 100% wick-burning stoves cause fires when knocked over</td>
</tr>
<tr>
<td>- 20 million people rely on them</td>
</tr>
<tr>
<td>- 46 000 fires and 3 000 deaths a year – Markinor</td>
</tr>
<tr>
<td>- Paraffin sold in unsafe containers, contain volatile impurities</td>
</tr>
<tr>
<td><strong>Benefits of ethanol gel</strong></td>
</tr>
<tr>
<td>- Burns cleanly – emits no harmful fumes</td>
</tr>
<tr>
<td>- Does not spread if stoves are knocked over</td>
</tr>
<tr>
<td>- Stoves aren’t pressurised, no danger of flash fires from leaking stoves</td>
</tr>
<tr>
<td><strong>Potential demand</strong></td>
</tr>
<tr>
<td>- 80m litres liquid paraffin, 3m wick stoves used annually</td>
</tr>
<tr>
<td>- Currently zero-rated but benefits don’t flow through</td>
</tr>
<tr>
<td>- Same material used for jet fuel</td>
</tr>
<tr>
<td>- Divert paraffin into jet-fuel market</td>
</tr>
<tr>
<td>- 4.6% increased in sales</td>
</tr>
</tbody>
</table>

Informal settlement fire in Khayelitsha, Cape Town. Shows typical paraffin fire (black smoke) and LP gas cylinder explosion (mushroom on the right) - Pasasa
Aerial view of aftermath of shack fire, Joe Slovo informal settlement, Cape Town, South Africa

Source: Paraffin Safety Association of SA
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ATTRACTION INVESTORS – Snapshot of Biodiesel Commercial Viability

Relationship between Prices and IRR

<table>
<thead>
<tr>
<th>% Price Change</th>
<th>IRR</th>
<th>Capex</th>
<th>Soya</th>
<th>Oilcake</th>
<th>$ Brent Crude</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50%</td>
<td></td>
<td>35.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-40%</td>
<td></td>
<td>30.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-30%</td>
<td></td>
<td>25.00%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-20%</td>
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<td>20.00%</td>
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<td></td>
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<tr>
<td>-10%</td>
<td></td>
<td>15.00%</td>
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<td></td>
<td></td>
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<tr>
<td>0%</td>
<td></td>
<td>10.00%</td>
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<tr>
<td>10%</td>
<td></td>
<td>5.00%</td>
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<tr>
<td>20%</td>
<td></td>
<td>0.00%</td>
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<tr>
<td>30%</td>
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<td>10%</td>
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<tr>
<td>40%</td>
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<td>15%</td>
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<td></td>
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<tr>
<td>50%</td>
<td></td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Current Prices: Oilcake @ R2 329, Beans @ R2 494

Capex: 646,193,889
Soya: 812.3901
Oilcake: 3,099
$ Brent Crude: $60.39

IRR: 18%
ATTRACTING INVESTORS – Address Risks on a Project-by-Project Basis

- Comparative Market Analysis: Agri-Commodity Futures vs. Liquid Fuels Trends
- Domestic and International Price, Volume and Access Trends
- Factory-to-Market Costs and Dynamics
- Technology and Process Analysis
- Field-to-Factory Costs and Dynamics
- Comparative Gross Farm Income Analysis
- Comparative Feedstock Analysis
- Cost of Production Analysis
- Factory-to-Field Costs and Dynamics
- Domestic and African Market Consumption Trends

- Field Crop Subsector
- Liquid Fuels Subsector
- Livestock Subsector

Policy and Legislation
### Small-scale farmers – a competitive advantage

<table>
<thead>
<tr>
<th>Energy crops can help turn marginalised farmers into commercial producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>High volumes, relatively low risks, liquid markets</td>
</tr>
<tr>
<td>Long production history</td>
</tr>
<tr>
<td>Can be stored and transported cost effectively – no requirement for cold chain maintenance etc.</td>
</tr>
<tr>
<td>Allow for large-scale regional production</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biofuel projects can act as anchor projects for rural development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a stable, bankable base of emerging farmers</td>
</tr>
<tr>
<td>Can be rotated with higher value cash crops and other biofuel crops</td>
</tr>
<tr>
<td>The livestock industry may benefit from increased animal feed supply</td>
</tr>
</tbody>
</table>

### Small-scale farmers – a competitive advantage

<table>
<thead>
<tr>
<th>Marginalised farmers brought into a stable supply chain, allowing ‘cooperative-type’ forms of organisation and capital investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased capital expenditure per farmer</td>
</tr>
<tr>
<td>Negotiating power as a purchaser and supplier</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enlarging the agri ‘pie’ does not displace current farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable offtake in the fuel industry facilitates risk-mitigated projects at supply level:</td>
</tr>
<tr>
<td>Finance for the un-banked</td>
</tr>
<tr>
<td>Allows economic actors to plan and invest in support services and infrastructure</td>
</tr>
<tr>
<td>Improves agro-processing sector risk profile through offtake in the separate fuel market</td>
</tr>
</tbody>
</table>

| Eg. Batswa ko Pele Project, South Africa |
ATTRACTING INVESTORS – Structuring Projects for Rural Development

Project Batswa ko pele – those who walk in front

by Hanlie du Plessis

Project Batswa ko pele was launched nine months ago in the Lichtenburg and Delareyville districts. Four role players, Absa, Monsanto, NWK and Omnia joined forces when they realised that emerging farmers need help to make a success of their farms.

The role players have the knowledge and the ability to transfer knowledge and experience to emerging farmers. A team of experienced people manage the project. They are Gerrie Ludick of Monsanto as the team leader, assisted by Philip Duthiewing of NWK, Philip Venter and Johan Shanyon of Omnia and David Stymnien of Absa.

Ten farmers attended a farmers’ day near Lichtenburg. To be part of this project the farmers had to:
- Haveimplants
- Have a valid contract for the ground they cultivate
- Be a member of NWK
- Have an Absa account
- Have an agricultural knowledge and history
- Have passion and a will to succeed

The farmers are not new farmers, but in the past they earned very little from the maize or sunflowers they planted. Some of the farmers even lost money. The team identified the reasons why the farmers did not do well:
- Upcoming farmers do not have enough funds to get the best inputs. Often when they have some money, it is too late in the season to help. They then plant too late and this causes poor yields
- The farmers often do not give enough attention to some of the inputs
- The farmers do not use the best technology available to the market, because they do not know about it
- One of the biggest problems in support. They need advice and knowledge transfer
- Upcoming farmers do not know enough about how the grain markets work. They make the wrong decisions about what crops to plant.

The Batswa ko pele team helped the farmers in these ways:
- NWK collected and registered soil samples and sent it to Omnia for analysis
- Recommendations were given to the farmers
- NWK did GPS surveys and drew up maps
- Absa helped the farmers to get production loans
- NWK opened accounts for all the farmers
- NWK did plomometer tests
- The technical committee visited all the members’ farms to establish the soil potential as well as the conditions of their implements and tractors
- NWK drew up production plans for the members
- Weekly training sessions with regular field visits were held
- Monitoring by telephone between the farmers and committee members.

Absa Mail visited the farm of Joseph Mhoba who takes part in the Batswa ko pele project. Even though he has been farming for most of his life, he says he knows nothing about the different cultivars and pesticides before. He is proud of the crops on his fields and realises that he still needs the help and support that the technical committee gives him. If the weather holds, Joseph’s yield will be much bigger this year.

At a gathering of the members, Kobus Lindouc, area director for Monsanto Sub-Sahara Africa, asked them to think of the newest vehicle or house they could imagine. He said that farmers do not farm to put seed in the ground; they farm to make money and ultimately be able to afford their dreams.

He warned against pointing fingers to other factors that might hinder their success. Reminding them that when pointing a finger there are three fingers pointing back to oneself, Lindouc assured them that the aim of the project is to make the farmers rich. They have got on their side the best companies in the sector, best technology, best products and strongest support they could wish for. He congratulated them on their efforts.

The project faced a couple of challenges:
- There is not enough money to repair machinery such as tractors, to buy diesel to plough
- The lands were covered by weeds and it was decided to plant a Roundup Ready white maize hybrid (KGK 78-35R) so that Roundup could be applied over the maize. The many rains caused the weeds to grow very well and also caused lots of diseases and pests
- Because they did not have transport, all the farmers could not attend the training sessions and field visits
- There is a huge problem and some of the farmers could not plant maize as it would have been stolen.

The committee feels that the Government should become involved in the project, especially with the provision of implements, such as tractors. It is also very important that all finance and planning issues should be done before November to enable the farmers to plant their crops in time.

Farmers must be taught how to make decisions and to take responsibility for making certain decisions.

Although the programme was limited to only a few farmers in the Lichtenburg and Delareyville districts, the plan is to involve more farmers in future.

Congratulations to all involved. Judging on the crops we have seen, this project is a certain success.
Limited Recourse Financing involves ‘ring-fencing’ cash-flow and risk areas, and allocating responsibility for risk areas to appropriately resourced and experienced roleplayers.